1. An integrated system approach

The road infrastructure, the ground and the buried utilities are interdependent infrastructures. Changes occurring in the ground conditions may cause deterioration and failure of the road and buried infrastructure.

2. The geotechnical infrastructure: how can we assess the ground conditions?

**Electromagnetic techniques**
- Respond well to changes in soil water content.

**Seismic techniques**
- Suitable for estimating the soil stiffness.

**Point sensors**
- Used in long-term monitoring. They supplement detailed soil information that can be used as ‘ground truth’.

3. Development of a new TDR methodology

A new TDR methodology was developed that allows the accurate measurement of both soil water content and density. The method was tested on 6 soil types with and without multiplexers indicating the potential for using TDR probes for this purpose in long-term monitoring applications.

4. Field testing: monitoring a leaking pipe

A field test site was developed in collaboration with Bristol Water. TDR and other buried sensors were able to detect changes in the soil properties induced by a water leaking pipe. The measured parameters can be used to inform shallow geophysical surveys.